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# Empirical Study on the M&A (merger and acquisition) performances of China energy enterprises

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# Empirical Study on the M&A (merger and acquisition) performances of China energy enterprises

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**Abstract:** DEA (Data Exchange Agreement) is used to make empirical study on the merger and acquisition performances of 46 China energy enterprises that happened from 2006 to 2012. The conclusions are listed as follow. Firstly, overall performances have a tendency of slow improvement, which is followed by a decline and then a remarkable enhancement. Secondly, sample performances of stock acquisition, which have a slow improvement, appear to be better than those of asset acquisition. Thirdly, during the first year after the acquisition, the performance of related party M&A is clearly better than that of unrelated party M&A. The performance of stock acquisition is unsteady while that of asset acquisition is steady and slow. And the performances of both stock acquisition and asset acquisition are basically the same. Fourthly, horizontal M&A show better performances than conglomerate M&A.

**Keywords:** Energy enterprises, M&A performances, DEA (Data Exchange Agreement)

## 1. INTRODUCTION

During recent decades, domestic and overseas scholars have conducted a large number of empirical studies on the M&A performances of enterprises. The available references mainly have 3 different methods to do empirical studies, which include event study (market approach), accounting study (financial index method) and DEA (Data Exchange Agreement).

Charnes (1992) and W.Cooper (2001) used theories of DEA to propose stability index, which can clearly measure the efficiency of a listed company before and after the M&A. Ehsan Feroz (2002) used this index to form a performance evaluation index which includes many financial data of a listed company to make empirical study on the changes of business performance that happened after the M&A.

Li Xindan (2003) used a sample of 103 listed companies that have M&A in stock markets of Shanghai and Shenzhen and applied DEA to calculate performance stability index before and after M&A.

After that, Wei Xudan (2005) and Li Honglei (2006) both used DEA to conduct empirical studies on the M&A performances of the listed companies in our country. Besides, DEA is also widely used in the empirical studies on the M&A performances of Chinese banks. It is used in the studies of Lin Bingwen (2005) and Liu Bin (2006).

All in all, domestic and overseas scholars have not reached a conclusion about the empirical studies on the M&A performances of enterprises. Though the same empirical method was used, the conclusions were different. And the reasons are listed as follow.

First and foremost, samples differ. The studies above use very comprehensive samples which are not classified according to their different characteristics such as industry, the scale and nature of the enterprises, the purposes of their M&A, their different external environments and the overall conditions of different enterprises. Therefore, after applying the same data processing method, scholars might have used different samples to reach different conclusions.

Secondly, the methods that the scholars used are different. The three empirical methods are used from

different values to evaluate the performances of the enterprises. Thus, different methods may result in different conclusions. Meanwhile, the three methods have their own flaws when they are utilized. First of all, when empirical methods use financial data, it may find it hard to distinguish the impacts that are brought by a single event since the financial data are accumulated chronologically. As a result, empirical studies that used financial data to evaluate the enterprise performance cannot directly reflect the effectiveness of the performances that are brought by the M&A of the enterprises. Therefore, the conclusion differed greatly. Second of all, the empirical studies that use stock prices can only be utilized to make short-term observation. However, the M&A of an enterprise has a long-term process. And it needs a time of integration to show the effect of M&A, showing the fact that when stock price is used to make short-term observation, it has certain limitations. Finally, no matter what methods are used, the samples referred to make positive analysis can hardly be pure or relatively pure. The factors that influence the business performance are various and M&A are the only few of them. The operation of an enterprise is a sustaining process. And there must be continuous matters that influence the business performance of an enterprise. Thus, there are hardly any samples that can be referred to provide a pure interval to evaluate the performance that M&A brought to an enterprise. Besides, the observation of the M&A needs a rather long period.

Thirdly, domestic scholars have different conclusions on the empirical studies of the M&A performances because in our country stated-owned share and legal person share cannot go on the market for a long time, making the evaluation of company market value has rather huge errors. Meanwhile, Chinese accounting system is not sound. And the processing of accounting information makes the accounting rate of return distorted, which influenced the evaluation of the M&A performance of the enterprises in our country. Thus, during the process of evaluating the M&A performance of domestic enterprises, the current situations should be taken into considerations. To choose a suitable study method or to create a method that suits our country to evaluate the M&A performance of the current situations can help make more precise and scientific evaluation of the M&A performances of the enterprises.

## 2. M&A performance evaluation based on DEA

When using annual management of a single energy enterprise as a DMU (decision making unit), seven consecutive years of DMU is a decision making unit system. And DEA (merger and acquisition) model is used to calculate annual performance values for the seven years. This calculation method will be applied to every sample to compute the annual performance index, which could be the basic data used to observe the M&A performance of listed energy companies.

### 2.1 Sampling

When using all the listed energy companies in stock markets of Shanghai and Shenzhen as a sample, the sample should be divided into 2 categories according to the fact that whether the M&A happened in 2009 to observe the performances. 2009 is chosen as a reference year for 2 main reasons. Firstly, according to the author's incomplete statistics, the listed energy companies still remained in the high point of M&A because it was prior to the complete opening up of our country and they can form a sufficient sample to represent all. Secondly, this paper is aimed at evaluating the long-term performances of enterprises that have M&A. Meanwhile, DEA need basic business information such as financial data that have a span of many years, so the M&A should have happened for several years.

In addition, the sample collected should fulfill the following conditions. Firstly, the sample companies should become listed before 2000. Secondly, the companies should have certain energy related businesses from 2000 to 2006 and they should not be delisted or change their main businesses. Thirdly, if a certain listed company has experienced several M&A in 2003, the most influential one will be documented. According to the

terms and standards mentioned above, the author chose 46 listed companies to form a sample to study from the 56 listed energy companies in stock markets of Shanghai and Shenzhen.

**2.2 Build the index system**

When choosing the input and output indices, DEA require the following conditions. Firstly, the evaluation purposes should be taken into considerations when selecting the input indices and output indices. Secondly, a strong linear relationship between the input and output indices should be avoided in order to enhance the coverage and effectiveness of the sample. Thirdly, the number of input and output indices should be smaller than the number of DMU. In this paper, it should be smaller than the observation period of 7 years. Fourthly, management controllability of input and output index and analysis availability of these statistics should both be considered.

APPROACHES TO BUILD THE MODEL

Following the requirements and the principles mentioned, 5 input and output index are chosen:

Input index:

X1 = Operation costs + business tariff and surcharges;

X2 = 3 costs (Operation, management and financial costs)

X3 = Total assets

Output index:

Y1 = Profits of main business

Y2 = Average annual total market value

The meanings of the index are described as follow.

X1 is the sum of operation costs and business tariff and surcharges. This is the cost relative to the income of the main business and can be used to effectively evaluate the resources that are used due to the operation of main business.

X2 is the sum of 3 costs, which are operation, management and financial costs. Operation costs occurred during daily operation when products are sold and services are provided and when sales organizations are located. Management costs occurred when administration department are organizing operation activities. Financial costs occurred when operational fund are raised. The sum of the three costs can be controllable financial index which can well reflect the resources used during operations.

(X1 +X2) can basically show the resources that are devoted when the enterprises are conducting operational activities at current time.

X3 is total assets. Assets are the resources that are owned or controlled by the company and the origin of the economic profits brought to the company. Total assets are used as an input index to more comprehensively reflect the resources that are used to conduct operational activities.

The meaning of output index is described as follow.

Y1 is profits of main business which occupied a rather large amount of the total profits. To maximize shareholders' return is the important objective of current enterprises. Therefore, profits of main business can reflect the operation performance from financial perspective as an important output index.

Y2 is average annual total market value. It is the average value of total market value during every business day in a year. For listed companies, the achievement and value of the companies' operation can be reflected by the stock price. Although Chinese capital market is weak effective, some important events such as M&A may still have influence on the stock price, which cannot be neglected. Therefore, the average annual total market value can effectively reflect the operation performance from the perspective of market.

Both the profits from main business and average annual market value are added into the index system of performance evaluation. It means that the index system try to evaluate the performance of the enterprises from

two sides, the comprehensive financial performance and market influences. To some extent, it overcomes the disadvantages of event study and accounting study and it will bring a more comprehensive insight about the performance of the company.

## 3. The sources and procession of data

In this evaluation system, the financial data used are from the newly adjusted M&A enterprises from 2006 to 2012. The information is all from the corresponding annual reports from the listed companies. Because the financial data processing methods of listed companies differ from each other and because the data can be easily controlled by others, several hypotheses are presented. Firstly, all the enterprises in the sample have the same financial processing method so that the financial data can be comparable on the base line. Secondly, the data from the annual reports can fully reflect the real business conditions of the enterprises and the reports are reliable and genuine.

**Table 1**.The performance value of energy companies in 2006~ 2012

| Stock code | Stock abbreviation | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|
| 601808 | COSL | 1.135 | 1.093 | 1.080 | 1.737 | 0.876 | 1.266 | 1.097 |
| 601857 | CNPC | 1.288 | 1.023 | 0.661 | 0.390 | 0.343 | 0.337 | 0.477 |
| 600028 | SINOPEC | 1.584 | 0.958 | 0.665 | 0.578 | 0.484 | 0.606 | 0.832 |
| 00857 | Petrochina shares | 1.897 | 0.996 | 0.765 | 0.741 | 0.494 | 0.873 | 0.953 |
| 000617 | Oil JiChai | 1.325 | 1.259 | 0.843 | 0.900 | 0.634 | 0.612 | 0.636 |
| 000600 | Built cast energy | 0.999 | 1.363 | 0.805 | 1.468 | 0.875 | 0.833 | 0.601 |
| 600508 | SDER | 1.209 | 1.102 | 0.810 | 0.761 | 0.455 | 0.438 | 0.470 |
| 601898 | China National Coal | 1.676 | 0.978 | 1.208 | 1.349 | 0.595 | 0.509 | 1.274 |
| 08192 | Global energy | 1.199 | 1.144 | 0.728 | 0.434 | 0.418 | 0.465 | 0.388 |
| 00076 | South sea petro | 1.661 | 1.282 | 0.902 | 0.863 | 0.921 | 1.028 | 1.153 |
| 00852 | Strait petrochemical | 1.762 | 0.897 | 0.559 | 0.340 | 0.313 | 0.339 | 0.488 |
| 00338 | Shanghai Petrochemical | 1.585 | 1.326 | 0.774 | 0.739 | 0.651 | 0.183 | 0.640 |
| 300164 | Tongyuan oil | 1.139 | 1.256 | 0.963 | 1.606 | 1.022 | 0.364 | 0.936 |
| 00346 | Shaanxi Yanchang Petroleum | 1.379 | 1.133 | 0.350 | 0.151 | 0.268 | 0.316 | 0.400 |
| 02688 | ENN ENERGY | 1.856 | 1.019 | 0.693 | 0.739 | 0.609 | 0.146 | 0.487 |
| 00384 | China gas hold | 1.100 | 1.102 | 0.961 | 0.713 | 0.409 | 0.817 | 1.572 |
| 00933 | Brightway Oil | 1.873 | 1.295 | 0.668 | 0.598 | 0.773 | 0.489 | 0.514 |
| 08011 | Polyard petro | 1.184 | 1.241 | 1.331 | 0.608 | 1.235 | 0.242 | 0.153 |
| 00003 | HKCG | 1.240 | 1.422 | 0.756 | 0.739 | 0.958 | 1.281 | 0.947 |
| 01193 | China resources gas limited | 1.014 | 1.094 | 1.010 | 0.999 | 0.571 | 1.059 | 1.251 |
| 601139 | Shenzhen gas corporation | 1.105 | 1.110 | 1.088 | 1.160 | 0.624 | 0.714 | 1.441 |
| 600116 | Three Gorge | 0.995 | 1.121 | 1.219 | 0.714 | 1.720 | 0.765 | 1.234 |
| 000698 | Shenyang chemical industry | 1.170 | 1.044 | 0.725 | 0.787 | 0.970 | 0.507 | 0.829 |
| 002092 | Zhongtai chemical | 0.909 | 1.194 | 1.539 | 0.725 | 0.353 | 0.772 | 0.807 |
| 600188 | Yankuang group | 1.098 | 1.199 | 1.572 | 1.040 | 0.775 | 0.760 | 0.760 |
| 600605 | Huitong enenrgy | 1.760 | 0.810 | 0.507 | 0.310 | 0.588 | 0.600 | 0.763 |
| 600396 | Jinshan share | 1.399 | 0.943 | 0.733 | 0.811 | 1.116 | 0.663 | 0.592 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 600256 | WCE | 1.217 | 0.941 | 0.912 | 0.646 | 0.798 | 0.581 | 0.594 |
| 600027 | HPI | 1.241 | 1.100 | 0.888 | 0.792 | 0.963 | 0.795 | 0.738 |
| 000690 | NREHL | 1.316 | 0.996 | 0.832 | 0.836 | 0.400 | 0.759 | 0.711 |
| 600674 | SFE | 1.239 | 1.263 | 0.974 | 0.857 | 0.627 | 0.801 | 1.277 |
| 002221 | COOHEC | 1.278 | 1.091 | 1.622 | 0.565 | 0.600 | 0.286 | 0.268 |
| 600795 | SP POWER DEVELOPMENT co., ltd | 1.198 | 0.949 | 0.704 | 0.642 | 0.627 | 0.556 | 0.703 |
| 601311 | Camel Group Co., ltd | 1.904 | 1.003 | 0.766 | 0.608 | 0.600 | 0.628 | 1.134 |
| 600482 | Fengfan Co., Ltd | 1.428 | 1.218 | 0.768 | 1.021 | 0.995 | 1.023 | 1.065 |
| 600387 | ZHEJIANG HAIYUE co., ltd | 0.947 | 1.100 | 1.359 | 0.879 | 0.765 | 0.800 | 1.711 |
| 300084 | Hammer technology | 1.305 | 1.219 | 0.906 | 0.712 | 0.895 | 0.706 | 0.617 |
| 002554 | HuiBo tome | 1.041 | 1.012 | 1.054 | 0.841 | 1.083 | 0.363 | 0.941 |
| 600837 | Hui haitong securities | 1.501 | 0.976 | 0.959 | 0.758 | 1.041 | 0.787 | 0.982 |
| 000593 | SICHUAN DATONG GAS DEV. co., ltd | 1.837 | 2.333 | 1.390 | 0.907 | 0.920 | 1.256 | 0.828 |
| 600792 | Cloud coal energy | 1.895 | 1.142 | 0.879 | 0.955 | 1.395 | 0.630 | 1.125 |
| 601948 | SDIC XINJI | 1.289 | 0.951 | 0.850 | 0.862 | 1.371 | 1.079 | 0.465 |
| 000968 | Coal gasificatin | 1.316 | 1.026 | 0.796 | 0.601 | 0.539 | 0.488 | 1.616 |
| 600027 | Huadian Power Internatioal | 1.289 | 1.162 | 0.827 | 0.582 | 0.472 | 0.452 | 0.528 |
| 600886 | SDIC Huajing Power Holdings co., ltd | 1.161 | 1.016 | 1.365 | 0.730 | 0.649 | 0.639 | 0.907 |
| 600011 | Huaneng Power International | 1.198 | 1.242 | 1.042 | 0.968 | 1.943 | 0.622 | 0.675 |

## 4. Positive analysis and results

(1) DEA is used to calculate every annual performance value and a single listed company is used as an evaluation system. The seven consecutive years (from 2006 to 2012) are used as 7 DMU. According to DEA theory and its model, the 3 input indices and 2 output indices of the company in these 7 years are used and "linprog" linear programming package of MATLAB is used to calculate every year's performance value of the company. Because the DEA model demands that all the input and output indices should be positive, the negative output indices would be translated according to translation invariance of DEA model, which fulfill the requirements of the indices in DEA.

If using the methods and following the steps mentioned above, 46 samples of performance values from 2006 to 2012 can be obtained.

(2) The descriptive statistics of Chinese listed energy companies used the 2009 annual reports of every sample to analyze the 46 samples and calculate the M&A that happened in 2009. There are 26 samples that have M&A in 2003. Among them, three M&A are involved with asset acquisition, eight samples are involved with stock acquisition, eight samples have related party M&A, 18 have unrelated party M&A and 12 samples have conglomerate and horizontal M&A. The samples are classified according to the type and method of M&A and the characteristics of those companies. Overall performance average value $\theta^*_{ave,j}$ is again calculated under each feature. (N means the number of the samples and j means the year of the event.)

$$\theta^*_{ave,j} = \frac{\sum_{i=1}^{n} \theta_{i,j}}{n}, \quad \text{n=1,…, n; j=2006,…, 2012}$$

**Table 2**. The mean of total value under difference condition and attributes

| Items | Num. of samples | The mean of performance value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 212 |
| Merger | 26 | 1.335 | 1.085 | 0.907 | 0.708 | 0.695 | 0.568 | 0.838 |
| Non-merger | 20 | 1.371 | 1.197 | 0.961 | 0.917 | 0.884 | 0.774 | 0.840 |
| Asset acquisition | 3 | 1.430 | 0.978 | 0.685 | 0.497 | 0.604 | 0.557 | 0.660 |
| Share acquisition | 8 | 1.517 | 1.086 | 0.936 | 0.776 | 0.805 | 0.520 | 0.845 |
| Association M&A | 8 | 1.309 | 1.095 | 0.969 | 0.714 | 0.899 | 0.602 | 0.885 |
| Non-affiliated M&A | 18 | 1.347 | 1.080 | 1.880 | 0.706 | 0.605 | 0.552 | 0.818 |
| Horizontal mergers | 12 | 1.383 | 1.104 | 0.795 | 0.649 | 0.682 | 0.591 | 0.917 |
| Conglomerate M&A | 12 | 1.223 | 1.089 | 1.023 | 0.745 | 0.749 | 0.568 | 0.753 |

## 5. Conclusions

According to the empirical results above, the M&A performances of Chinese energy enterprises are analyzed in 4 main aspects including overall conditions, trading mode (stock acquisition and asset acquisition), related party M&A (related party M&A and unrelated party M&A) and methods of M&A (horizontal M&A and conglomerate M&A).

### 5.1 The overall conditions of M&A performances of Chinese energy enterprises

First of all, the performances of the 26 samples which had M&A in 2003 are described and analyzed. They are then compared with the performances of the 20 samples which didn't have M&A in 2003.

#### 5.1.1 The overall performances from 2006 to 2012 of the enterprises which had M&A in 2009

The overall performance tendency shows that M&A have brought certain performance enhancement to Chinese energy enterprises. First of all, during the first year after the M&A, the decline tendency of the average value for the overall performance of the samples has been slowed. M&A have brought short-term enhancement of the performance for the enterprises. But it can not be excluded that this kind of improvement is made by the merger of their financial statements. Besides, during the second year after the M&A, the performance of the enterprises went down, but the speed of its decline is clearly much smaller than that of the decline 3 years prior to the M&A. This year's decline happened because after M&A a large number of resources of the enterprise are exhausted. But the negative influences of blind M&A of the energy enterprises cannot be excluded. Finally, the overall performance during the third year after M&A shows a swift improvement, which indicates that the M&A in 2009 are effective after 2 years' integration. Synergistic effect gradually appeared and brought profits to the companies and improved their performances. However, since the output indices include the average total market value of the company in the model and since the stock price of our country began to soar in 2012, some of the companies' total market values quickly went up. And this is one of the main reasons that the M&A performances of the energy enterprises in 2006 began to appears obvious.

#### 5.1.2 The comparison between the performances of the listed companies that had and didn't have M&A in 2009

According to the statistics, 20 energy companies did not have M&A in 2009. We can compare between these 20 samples' average performance value and the 26 samples of the M&A calendar year average performance value to examine the performance differences of the two samples.

The differences between the energy enterprises that had M&A in 2009 and the listed companies are listed as followed. M&A energy companies in 2009 and did not occur in the mergers and acquisitions of listed companies' performance.

The performances of the two samples were not significantly different in the two years prior to the takeover.

Since the mergers and acquisitions began at the beginning of the year, the average performance differences of the two samples began to widen, the performances of the listed companies' mergers and acquisitions are significantly better than the performances of the listed companies that didn't have M&A. And the performance gap maintained about 20% in the two years after the M&A. The author believed that this difference is mainly derived from the internal friction of M&A in the enterprises. From 2011, enhancement of the speed of the performances of listed companies that had M&A is significantly faster than that of the listed companies that didn't had M&A. The performances values of the companied had and didn't have M&A are the same in 2012. As a result, it's very apparent that M&A can bring continuous power for the company to grow in the long run.

In addition, the average performance value of the 2 samples prior to 2008 exists in the effective range of DEA. However, after 2008 the average performance values are not effective. That is, before 2008 the performances of the energy enterprises are effective and they are in a good operation conditions. After 2008, the performance level cannot reach a state of effectiveness so that the resources cannot bring about the maximum profits, which indicates an unhealthy condition of recent years' development of the energy industry. The fundamental reason is that the energy industry is currently saturated. The vicious competition is common in this industry. And the quality of the industry cannot be improved, which results in the ineffective condition of the performances of the companies.

### 5.2 Equity/assets acquisition and performance of M&A enterprise

Different M&A transactions have certain effects on M&A performances. The author compared the average performance value of the sample of assets acquisition and equity acquisition. First of all, the sample's average p erformance value of the equity acquisition is overall superior to that of assets acquisition. Secondly, the perform ance value of equity acquisition is not very stable, while the general performance value of assets acquisition had a steady and slow rising trend.

### 5.3 Associated/non-affiliated M&A and performance of M&A

It can also be examined about the enterprise performance level associated with M&A and non-affiliated M&A. According to the author's incomplete statistics, within the M&A of the 26 energy enterprise happened in the listed companies, eight listed companies had related party M&A and 18 listed companies had non-affiliated M&A in 2009. As for the companies' overall performances level, both the companies had associated M&A and the companies had non-affiliated M&A share the same level of performances. An enterprise's performance level is significantly higher than that of an enterprise that had non-related mergers and acquisitions or corporate acquisitions within two years after the occurrence associated with mergers and acquisitions. In other years, the levels of performances of the two samples are basically the same.

### 5.4 Horizontal and conglomerate M&A vs. Performance of M&A

M&A can be divided into horizontal M&A, vertical M&A and conglomerate M&A according to its industri al features. The overall levels of energy enterprise performance under different means of M&A were calculated separately based on the relationship between acquiring and acquired businesses in 26 sample events. Because th ere are only 2 enterprises that have vertical M&A, their average performance will not be taken into account.

From the 12 listed energy companies that had conglomerate M&A, their overall performances show that the companies that had conglomerate M&A exhibit better performances within a year after than the companies that had horizontal M&A. But in the second half of the second year and the whole third year, the enterprises that had conglomerate M&A would show uneven performances while the enterprises that had horizontal M&A would enjoy noticeable enhancement after minor decline, surpassing the enterprises had conglomerate M&A. Therefore, it's sure that horizontal conglomerate can bring much more steady performance enhancement for the energy companies in our country.

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